CLAIMS

1. A flexible sheet structure comprising a plurality of modules connected together, said plurality of modules being connected together so that each module is capable of rotating about first and second axes with respect to a neighbouring module to which it is connected, said first axis being parallel to the plane of the sheet when laid flat and said second axis being orthogonal to the plane of the sheet when laid flat.

2. A flexible sheet structure according to claim 1, wherein a module can rotate relative to a neighbouring module to which it is connected about said axis parallel to the plane of the sheet when laid flat through at least the full range of -10° to +10°.

3. A flexible sheet structure according to claim 2, wherein said rotation is at least through the full range of -20° to +20°.

4. A flexible sheet structure according to claim 2 or 3, wherein a module can rotate relative to a neighbouring module to which it is connected about said axis parallel to the plane of the sheet when laid flat by between no more than -60° and no more than +60°.

5. A flexible sheet structure according to claim 4, wherein said rotation is between no more than -30° and no more than +30°.

6. A flexible sheet structure according to any one of the preceding claims, wherein a module can rotate relative to a neighbouring module to which it is connected about said axis orthogonal to the plane of the sheet when laid flat through at least the full range of -10° to +10°.

7. A flexible sheet structure according to claim 6, wherein said rotation is at least through the full range of -30° to +30°.

8. A flexible sheet structure according to claim 7, wherein said rotation is at least through the full range of -80° to +80°.

9. A flexible sheet structure according to any one of the preceding claims, wherein each module has a plurality of nodes and at least one of said modules has each of its plurality of nodes connected to a node of a different neighbouring module.

10. A flexible sheet structure according to claim 9, wherein each module has 3 and only 3 nodes.

11. A flexible sheet structure according to claim 9, wherein each module has 4 and only 4 nodes.

12. A flexible sheet structure according to claim 9, 10 or 11, wherein each node is located at the end of an arm.

13. A flexible sheet structure according to claim 11 or 12, wherein each arm of the module lies parallel to the plane of the sheet when laid flat.

14. A flexible sheet structure according to any one of claims 10 to 13, wherein each nodal connection is a single joint that allows both said rotation orthogonal to the plane of the sheet when laid flat and said rotation parallel to the plane of the sheet when laid flat, preferably simultaneously such that rotation about a single axis intermediate said orthogonal and parallel axes is possible.

15. A flexible sheet structure according to claim 14, wherein said single joint has a neutral axis oriented at substantially 90° to the plane of the sheet when laid flat.

16. A flexible sheet structure according to claim 14, wherein said single joint has a neutral axis oriented at an angle to the plane of the sheet when laid flat.

17. A flexible sheet structure according to claim 14, wherein said single joint has a neutral axis oriented substantially parallel to the plane of the sheet when laid flat.

18. A flexible sheet structure according to claim 14, 15, 16 or 17, wherein said single joint is a ball/socket joint.

19. A flexible sheet structure according to claim 18, wherein said ball/socket joint is a double ended ball/socket joint comprising two balls and two sockets.

20. A flexible sheet structure according to claim 1, wherein a module can rotate relative to a neighbouring module to which it is directly or indirectly connected about said axis parallel to the plane of the sheet when laid flat by between at least the full range of -90° to +90°.

21. A flexible sheet structure according to claim 20, wherein a module can rotate relative to a neighbouring module to which it is directly or indirectly connected about said axis parallel to the plane of the sheet when laid flat by between at least the full range of -180° to +180°.

22. A flexible sheet structure according to claim 1, 20 or 21, wherein a module can rotate relative to a neighbouring module to which it is directly or indirectly connected about said axis orthogonal to the plane of the sheet when laid flat by at least between -100° and +100°.

23. A flexible sheet structure according to claim 20, 21 or 22, wherein a module can rotate relative to a neighbouring module to which it is directly or

indirectly connected about said axis parallel to the plane of the sheet when laid flat by between no more than -120° and no more than +120°.

24. A flexible sheet structure according to any one of claims 1 to 13 or 20 to 23, wherein at least one module of said sheet is connected to a neighbouring module via a linking component.

25. A flexible sheet structure according to claim 24, wherein said at least one module is connected to said linking component by a joint which allows relative rotation between the module and linking component about said axis parallel to the plane of the sheet when laid flat.

26. A flexible sheet structure according to claim 24 or 25, wherein said linking component comprises two members connected together by a joint which allows relative rotation between the two members about an axis orthogonal to the plane of the sheet when laid flat.

27. A flexible sheet structure according to claim 24, 25 or 26, wherein each module is connected to a linking component by a joint which allows relative rotation between the module and the linking component about said axis orthogonal to the plane of the sheet when laid flat.

28. A flexible sheet structure according to claim 24, 25, 26 or 27, wherein said linking component is a single linear member having a ball at each end thereof.

29. A flexible sheet structure according any one of the preceding claims, wherein the modules and optional linking components are connected together so as to form a regular pattern of closed loops in said plane.

30. A flexible sheet structure according to claim 25, wherein the loops can close in to reduce in area while the sheet remains flat due to relative rotation of modules about said axis orthogonal to the plane of the sheet when laid flat.

31. A flexible sheet structure according to any one of the preceding claims, wherein the effective area of the whole or part of the sheet can be varied while the sheet remains flat.

32. A flexible sheet structure according to claim 31, wherein the area of said sheet can be reduced to 80% or less of its original size, while remaining flat.

33. A flexible sheet structure according to claim 31, wherein the area of said sheet can be reduced to 60% or less of its original size, while remaining flat.

34. A flexible sheet structure according to claim 34, wherein the area of said sheet can be reduced to 40% or less of its original size, while remaining flat.

35. A flexible sheet structure according to any one of the preceding claims, wherein each module is capable of rotating relative to a neighbouring module to which it is connected about each of the mutually orthogonal axes that lie in the plane of the sheet when laid flat.

36. A flexible sheet structure according to any one of the preceding claims, wherein each module is connected to a plurality of neighbouring modules.

37. A flexible sheet structure comprising a plurality of modules connected together, at least one of said modules being connected to another said module by a multiple degree of freedom joint that has a neutral axis oriented substantially at 90° to the plane of the sheet when laid flat.

38. A flexible sheet structure according to claim 37, wherein each said module of the sheet is connected to another module by a multiple degree of freedom joint that has a neutral axis oriented substantially at 90° to the plane of the sheet when laid flat.

39. A flexible sheet structure comprising a plurality of first and second connected components, each said first component being connected to a said second component by a joint that allows for relative rotation about an axis parallel to the plane of the sheet when flat and each said second component being connected to a neighbouring said second component by a joint that allows for relative rotation about an axis orthogonal to the plane of the sheet when flat.

40. A flexible sheet structure according to claim 39, wherein each first component has three arms spaced by about 120° in the plane of the sheet when laid flat and each second component is a linear member having said joints disposed at each end thereof.

41. A flexible sheet structure comprising a plurality of modules connected together, each of said modules having first, second and third arms, each of said arms being regularly spaced from the other two said arms, each said arm being connected to an arm of a neighbouring said module so that each module of the sheet is capable of rotating with respect to its neighbouring module about an axis orthogonal to the plane of the sheet when laid flat.

42. A flexible sheet structure according to any one of the preceding claims, wherein each module is constructed of substantially rigid and non-flexible plastics material.

43. A flexible sheet structure according to any one of the preceding claims, wherein the connections between modules are arranged such that pure relative translation between neighbouring modules is not possible.

44. A flexible sheet structure according to any one of the preceding claims, wherein each module in the sheet is substantially similar in shape to the other modules of the sheet.

45. A flexible street structure comprising a plurality of modules connected together, said plurality of modules being connected together so as to allow the effective area of the sheet to be varied while the sheet remains flat and to allow out of plane movement so that the sheet may be smoothly conformed around complex shapes.

46. A flexible sheet structure according to any one of the preceding claims, further comprising additional material applied so as to give a smooth outer surface for said sheet structure.

47. A flexible sheet structure according to claim 46, wherein said additional material is a thin covering material adhered to the plurality of modules.

48. A flexible sheet structure according to claim 46, wherein said additional material is applied as a fluid so as to encapsulate the plurality of modules.

49. A module for use in the flexible sheet structure of any one of the preceding claims.

50. A module for use in a flexible sheet structure, said module having arms each comprising one half of a multiple degree of freedom joint, for connection with the other half of the multiple degree of freedom joint located on an arm of a neighbouring module in the sheet, said multiple degree of freedom joint half being oriented such that the resulting multiple degree of freedom joint will have a neutral axis oriented out of the plane of the sheet when flat.

51. A module according to claim 50, wherein said multiple degree of freedom joint half is oriented at 90° to the major plane of the module.

52. A module according to claim 50 or 51, wherein said multiple degree of freedom joint half is one of a ball and a socket.

53. A lockable articulated structure comprising a plurality of modules connected together so that said modules are selectively moveable with respect to one another, at least one connection between two said modules comprising a locking material capable of assuming at least two states, said at least two states including a first state which allows relative movement of said components and a second state which at least substantially prevents such movement, a transition between said two states being accomplished by the selective introduction of energy to said locking material.

54. A structure according to claim 53, wherein said selective movement is rotation.

55. A structure according to claim 54, wherein said rotation is about more than one axis.

56. A structure according to claim 53, 54 or 55, wherein said first state is a softer state than said second state.

57. A structure according to claim 56, wherein said second state is a frozen state.

58. A structure according to claim 57, wherein said transition is from said frozen state to said soft state and is accomplished by providing heat to said locking material.

59. A structure according to claim 58, wherein said locking material is susceptible of being heated by microwave energy to a greater extent than the material of the articulated structure such that heat may be provided to said locking material by subjecting the whole structure to microwave radiation.

60. A structure according to claim 53, 54 or 55, wherein said first state is an expanded state and said second state is a compressed state.

61. A structure according to claim 53, 54 or 55, wherein said first state is a compressed state and said second state is an expanded state.

62. A structure according to claim 60 or 61, wherein said transition is from said compressed state to said expanded state and is accomplished by providing heat or electricity to said locking material.

63. A structure according to claim 53, 54 or 55, wherein said first state is a non-adhered state and said second state is an adhered state.

64. A structure according to claim 63, wherein said transition is from said non-adhered state to said adhered state and is accomplished by providing heat, UV radiation or electricity to said connection.

65. A structure according to claim 53, 54 or 55, wherein said first state is a pressurised state and said second state is a unpressurised or less pressurised state.

66. A structure according to claim 65, wherein said transition is from said unpressurised or less pressurised state to said pressurised state and is accomplished by pumping a hydraulic or pneumatic fluid through said connection.

67. A structure according to any one of claims 53 to 66, wherein said transition is reversible.

68. A structure according to any one of claims 53 to 67, wherein said connection is a ball-socket joint and said locking material is disposed at least partly around the ball.

69. A structure according to claim 68, wherein said ball and/or socket has a flat portion and said locking material is located adjacent said flat portion.

70. A structure according to claim 68 or 69, wherein there are provided topographical features that prevent rotation about the neutral axis of said ball/socket joint when said structure is locked.

71. A structure according to claim 70, wherein said ball or socket has one or more groove-shaped topographical features in which said locking material is located.

72. A structure according to any one of claims 53 to 67, wherein said connection is a pivot comprising a shaft part and an annular part.

73. A structure according to claim 72, wherein said locking material is located between said shaft part and said annular part.

74. A structure according to claim 73, wherein said shaft or annular part has a non-cylindrical face and said locking material is located adjacent said face.

75. A structure according to any one of claims 53 to 74, wherein said material is a thermoplastic material.

76. A structure according to any one of claims 53 to 75, wherein said material is a eutectic material.

77. A structure according to any one of claims 53 to 76, wherein said material is a thermosetting material.

78. A structure according to any one of claims 53 to 77, where said material is a polymer.

79. A structure according to any one of claims 53 to 78, wherein said material is a thixotrophic fluid or a rheopectic fluid so as to provide differing amounts of effective viscosity according to the level of force acting on the structure.

80. A flexible sheet structure comprising the lockable articulated structure of any one of claims 53 to 79.

81. A flexible sheet structure according to any one of claims 1 to 48, wherein at least two modules are lockably connected together in accordance with any one of claims 53 to 79.

82. A flexible sheet structure according to claim 81, wherein all the connections in the sheet are lockable in accordance with any one of claims 53 to 79 so that the sheet is selectively conformable and lockable.

83. A spinal brace comprising the flexible sheet structure of any one of claims 1 to 47 or 53 to 82.